What is the probability of having at least three successes?

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The probability of having at least three successes refers to the likelihood that out of a given number of attempts or trials, at least three of them will be successful. This can be calculated by dividing the number of successful outcomes by the total number of possible outcomes. It is a measure of the likelihood of achieving a desired outcome or reaching a certain level of success. This probability is often used in decision-making and risk analysis to determine the chances of achieving a particular goal or outcome.

Find the Probability of "At Least Three" Successes

We can use the following general formula to find the probability of at least three successes in a series of trials:

P(at least 3) = 1 - P(0 successes) - P(1 success) - P(2 successes)

In the formula above, we can calculate each probability by using the following formula for the :

P(X=k) = nCk * pk * (1-p)n-k

where:

n: number of trialsk: number of successesp: probability of success on a given trialnCk: the number of ways to obtain *k* successes in *n* trials

The following examples show how to use this formula

to find the probability of "at least three" successes in different scenarios.

Example 1: Free-Throw Attempts

Ty makes 25% of his free-throw attempts. If he attempts 5 free-throws, find the probability that he makes at least three.

First, let's calculate the probability that he makes exactly zero, exactly one, or exactly two free-throws:

P(X=0) = 5C0 * .250 * (1-.25)5-0 = 1 * 1 * .755 = 0.2373

P(X=1) = 5C1 * .251 * (1-.25)5-1 = 5 * .25 * .754 = 0.3955

P(X=2) = 5C2 * .252 * (1-.25)5-2 = 10 * .0625 * .753 = 0.2636

Next, let's plug these values into the following formula to find the probability that Ty makes at least three free-throws:

P(X≥3) = 1 - P(X=0) - P(X=1) - P(X=2)P(X≥3) = 1 - .2373 - .3955 - .2636P(X≥3) = 0.1036

The probability that Ty makes at least three free-throws

in five attempts is 0.1036.

Example 2: Widgets

First, let's calculate the probability that exactly zero, exactly one, or exactly two are defective:

P(X=0) = 10C0 * .020 * (1-.02)10-0 = 1 * 1 * .9810 = 0.8171

P(X=1) = 10C1 * .021 * (1-.02)10-1 = 10 * .02 * .989 = 0.1667

P(X=2) = 10C2 * .022 * (1-.02)10-2 = 45 * .0004 * .988 = 0.0153

Next, let's plug these values into the following formula to find the probability that at least three widgets are defective:

P(X≥3) = 1 - P(X=0) - P(X=1) - P(X=2)P(X≥3) = 1 - 0.8171 - 0.1667 - 0.0153P(X≥3) = 0.0009

The probability that at least three widgets are defective in this random sample of 10 is 0.0009.

Example 3: Trivia Questions

Bob answers 60% of trivia questions correctly. If we ask

him 5 trivia questions, find the probability that he answers at least three correctly.

First, let's calculate the probability that he answers exactly zero, exactly one, or exactly two correctly:

P(X=0) = 5C0 * .600 * (1-.60)5-0 = 1 * 1 * .405 = 0.01024

P(X=1) = 5C1 * .601 * (1-.60)5-1 = 5 * .60 * .404 = 0.0768

P(X=2) = 5C2 * .602 * (1-.60)5-2 = 10 * .36 * .403 = 0.2304

Next, let's plug these values into the following formula to find the probability that he answers at least three questions correctly:

P(X≥3) = 1 - P(X=0) - P(X=1) - P(X=2)P(X≥3) = 1 - 0.01024 - 0.0768 - 0.2304P(X≥3) = 0.6826

The probability that he answers at least three questions correctly out of five is 0.6826.

Bonus: Probability of "At Least Three" Calculator

Use to automatically find the probability of "at least three" successes, based on the probability of success in a given trial and the total number of trials.